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Washing machine having a liquid flow distribution valve.

A washing machine comprises a valve (15) for distributing the flow of a liquid circulated by a pump (8) having its outlet connected to an inlet of said valve, the latter being provided with a closure element (18) and a first and a second outlet (16, 17) connected respectively to a first and a second conduit (14, 13).

The first conduit (14) extends upwards to a level above that of the first conduit. The closure element (18) is normally constrained by the action of gravity to assume a stable position adjacent the first outlet (16) so as to obturate it during a first actuation phase of the pump (8). A bypass conduit (20) connects the outlet (10) of the pump to the first outlet (16) of the valve. When the pump (8) is deenergized the closure element (18) assumes an instable position adjacent the second outlet (17), and when the pump is again actuated after an interval which is longer or shorter than a predetermined period of time, the closure element (18) is caused to respectively obturate the first or second outlet (16, 17) of the valve (15). This enables the rotary spray arms (11, 12) of a dish-washing machine for instance to be selectively activated.

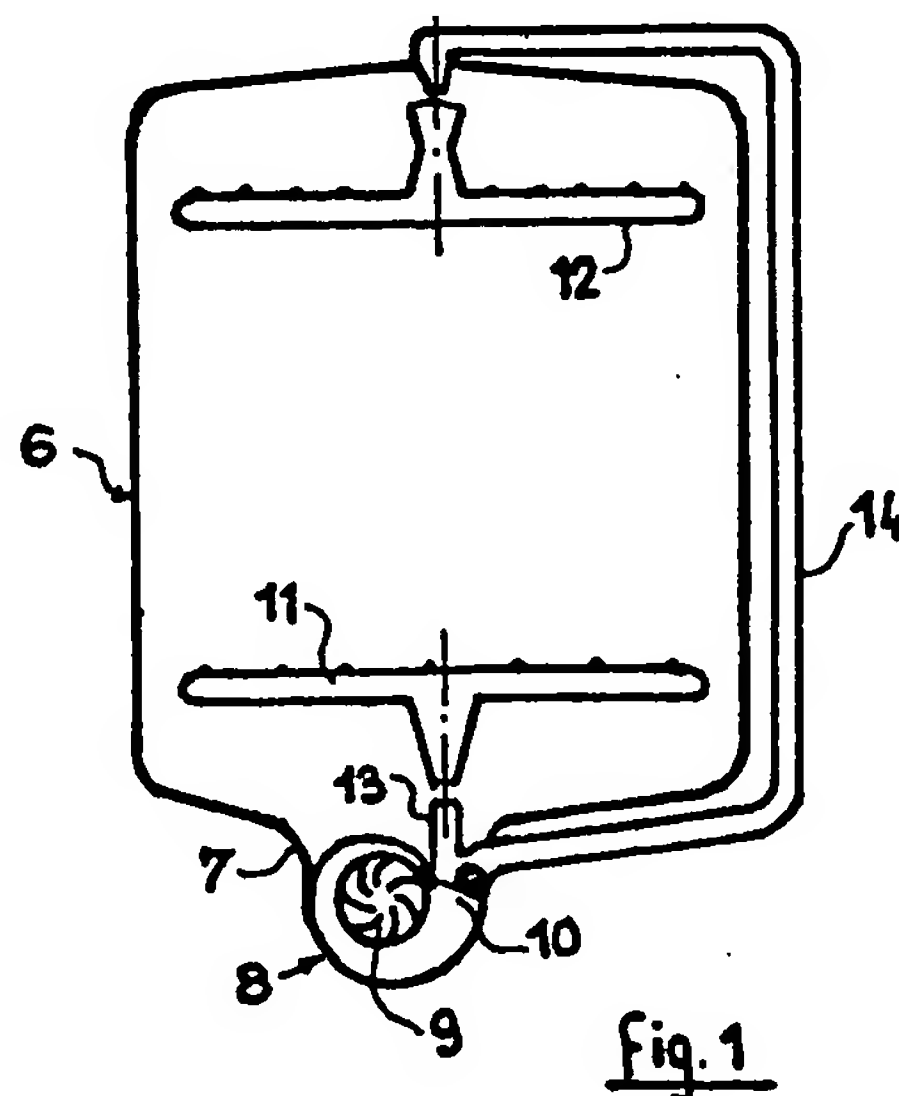


Fig. 1

1 Description

The present invention relates to an automatic washing machine, particularly to a dishwashing machine, provided
5 with a valve for the distribution of the flow of a liquid circulated within a liquid flow conduit system of the machine.

Dishwashing machines are in particular provided with a
10 washing liquid circulation pump adapted to supply two rotary spray arms disposed at different levels. To this purpose the outlet of the circulation pump diverges into two branch conduits each connected to a respective spray arm.

15 With a view to reducing the dimensions of the pump motor and of the circulation conduit system, and to reducing the noise produced by the impact of the washing liquid jets on the dishes and the like loaded into the machine, it is preferable to supply the washing liquid alternately to the
20 rotary spray arms instead of simultaneously.

To this purpose there have already been proposed, for instance in Italian Patent Application No. 21702 A/81, filed on May 14, 1981 in the name of Industrie Candy S.p.A.,
25 deviator means adapted to alternately connect the outlet of the circulation pump to the rotary spray arms of a dishwashing machine; these deviator means are actuated, however, by the program control unit of the machine by the employ of electromechanical devices or the like, whereby
30 the construction of the machine is undesirably complicated, and its reliability is possibly impaired.

These shortcomings are substantially evitable as described in Italian Patent No. 952,781, according to which the
35 circulation pump of a dishwashing machine is connected to two rotary spray arms through a distribution valve having a closure element of the bistable type, i. e. capable of being seated, by the action of gravity, on a first or a

1 second valve seat in the inoperative state of the pump.
The pump is intermittently actuated by the program control
unit of the machine, and the two valve seats, formed
substantially in a ω -configuration, are disposed closely
5 below two associated outlet conduits of the valve. As a
result, the closure element alternately obturates one or
the other outlet conduit of the valve during successive
actuation phases of the pump, while during the pump stopp-
age intervals the closure element is constrained by gravity
10 to be seated alternately on the first and the second valve
seats.

This distribution valve is thus advantageously directly
actuated by the fluid pressure and by the action of gravity,
so that it does not require any electromechanical actuators
15 or the like. On the other hand, however, the operation of
this valve is rather critical and susceptible to be impaired
by the presence in the liquid flow of dirt particles which
may be deposited even in small amounts adjacent the valve
seats to thereby prevent the closure element from being
20 switched between its two above mentioned stable positions,
resulting in improper operation of the machine.

It is therefore an object of the present invention to
provide a washing machine comprising a valve adapted to
25 distribute between different outlet conduits a liquid flow
received at an inlet, without any problems being created
by deposits of dirt and without the requirement of any
electromechanical actuator elements or the like.

30 According to the invention this object is attained in
a washing machine comprising a distribution valve for the
flow of a liquid circulated by a pump having an outlet
connected to said valve, the latter being provided with at
least one closure element and at least a first and a second
35 outlet connected respectively to a first and a second
liquid flow conduit, said first liquid flow conduit ex-
tending substantially upwards to a level above that of
said second conduit,

1 this machine being characterized in that said closure
element is normally positioned by the action of gravity at
a stable position adjacent said first outlet and adapted
to be displaced to a position obturating said first outlet
5 when said pump is actuated during a first phase, a calibrated bypass passage connecting said outlet of said pump
to said first outlet of said valve, said closure element
being adapted at the end of a phase of actuation of said
pump to be displaced to an instable position adjacent said
10 second outlet and to assume a position obturating said
second outlet during a subsequent actuation phase of said
pump only when said subsequent actuation phase is initiated
within a predeterminend period of time after termination
of said first phase.

15 The characteristics and advantages of the invention will
become evident from the following description, given by
way of example with reference to the accompanying drawings, wherein:

20 fig. 1 shows a diagrammatical illustration of the main
parts of a washing machine according to the invention, and
figs. 2 to 5 show diagrammatic illustrations of a preferred
embodiment of a detail of the machine shown in
25 fig. 1 in different operative positions.

With reference to fig. 1, the washing machine according to
the invention is preferably a dishwashing machine mainly
comprising a washing tub 6 provided at its bottom with a
collecting receptacle 7 for a washing liquid supplied to
30 the machine in a known and therefore not shown manner.
Disposed at the bottom of receptacle 7 is the intake of a
circulation pump 8 having a rotor 9 driven by an electric
motor. The output of pump 8 supplies at least two rotary
spray arms 11 and 12 disposed in tub 6 at different levels
35 adjacent respective trays (not shown for simplicity's sake)
adapted to support the articles to be washed.

1 In particular, the outlet 10 of pump 8 is connected to
spray arm 11 by a conduit 13 extending upwards for a short
distance, and to spray arm 12 by a conduit 14 extending
upwards to a substantially higher level than conduit 13.

5 The connection of conduits 13 and 14 to outlet 10 of pump 8
is accomplished, as shown in figs. 2 to 5, by a washing
liquid flow distribution valve 15. More precisely, valve 15
has an inlet connected to outlet 10 of pump 8, and a first
10 and a second outlet 16, 17 connected respectively to con-
duits 14 and 13. Contained within valve 15 is at least one
closure element 18, preferably comprising a spherical body
made of any suitable inoxidable material having a higher
specific gravity than the washing liquid employed in the
15 machine.

In the normal state, i.e. when pump 8 is inoperative,
closure element 18 rests on guides 19 in the shape for
instance of parallel ridges formed integrally with the body
of valve 15 at the interior surface thereof. As shown in
20 fig. 2, guides 19 are located below outlets 16 and 17 and
slightly inclined downwards from outlet 17 towards outlet
16, so that closure element 18 is constrained by the
action of gravity to assume a stable position adjacent
outlet 16 of valve 15. The inlet of valve 15 (i.e. outlet
25 10 of pump 8) is additionally connected to outlet 16 through
a calibrated bypass passage 20 designed in any suitable
manner and provided for instance with means adapted to
cause a leakage loss when closure element 18 obturates
outlet 16 of valve 15, as will be explained with reference
30 to fig. 3.

Circulation pump 8 is preferably adapted to be intermit-
tently actuated in a per se known manner by the program
control unit of the machine (not shown for the sake of
35 simplification).

During a first operating phase of pump 8 (fig.3) the
liquid pressure at the inlet of valve 15 acts to lift

1 closure element 18, causing it to assume a position
adjacent outlet 16 to thereby obturate it.

The liquid flow generated by circulation pump 8 is thus
5 substantially directed through conduit 13 to be supplied
only to the lower rotary spray arm 11 of the machine. At
the same time, however, a small proportion of the liquid
flow is deviated through bypass passage 20 to substantially
fill conduit 14.

10 When pump 8 is subsequently stopped, the liquid contained
in conduits 13 and 14 flows back towards pump 8 by the
action of gravity. While the amount of liquid contained in
conduit 13 is negligible, the liquid contained in conduit
14, which, as already explained, extends to a relatively
15 high level, exerts a hydrostatic pressure on sphere 18,
causing it to drop onto guides 19 and to be displaced
therealong (overcoming the vertical component of the force
of gravity) towards an instable position adjacent outlet 17
of valve 15 (fig. 4).

20 Closure element 18 remains in this instable position
substantially until conduit 14 is empty, that is, for a
predetermined period of time of for example 1.5 seconds,
depending on the parameters of the liquid flow conduit
25 system of the machine.

When circulation pump 8 is subsequently actuated prior to
termination of this predetermined period of time, i.e.
when closure element 18 is still in its instable position
shown in fig. 4, the liquid pressure at the inlet of
30 valve 15 acts to lift closure element 18 to a position
obturating outlet 17 (fig.5).

The liquid flow generated by circulation pump 8 is now
substantially directed through conduit 14 to be supplied
35 only to the upper rotary spray arm 12 of the machine.

Subsequent deenergization of pump 8 results in the operative
conditions described with reference to fig. 4 to be again

1 established. At the end of the predetermiend period of
time, i.e. when conduit 14 is empty, the force of gravity
causes closure element 18 to be displaced along guides 19
from the instable position of fig. 4 to the stable position
5 shown in fig. 2. Therefore when pump 8 is again actuated
after expiry of the predetermined period of time, valve 15
will again assume the operative position described with
reference to fig. 3.

10 On the understanding that a first actuation phase of pump 8
will always result in the condition shown in fig. 3, it is
thus possible to selectively control the supply of the
fluid flow to lower spray arm 11 or upper spray arm 12 by
interrupting the operation of pump 8 for an interval which
15 is longer or shorter, respectively, than the predetermined
period of time.

According to another aspect of the invention, pump 8 is
thus actuated by the (preferably electronic) program
control unit of the machine in an intermittent manner
20 with intervening stoppage intervals of a shorter and longer
duration, for instance 0.5 and 2 seconds, than said
predetermined period of time. As a result the machine
operates with the liquid flow being alternately supplied
to rotary spray arms 11 and 12.

25 It is of course possible to suitably vary the duration of
the stoppage intervals of the pump to thereby correspond-
ingly vary the sequence of the liquid flow supply to spray
arms 11 and 12, or to supply the liquid flow to only a
30 selected one thereof.

In each case the operation of flow distribution valve 15 is
reliable and accurate due to its monostable design, closure
element 18 having only a single predetermined stable pos-
35 ition (fig. 2).

The descriebd machine may of course by modified in any
suitable manner within the purview of the invention.

1 The invention may thus be applied to a laundry washing
machine of the washing liquid recirculation type, in
which case valve 15 may be employed for selectively
controlling the recirculation and discharge of the washing
5 liquid.

The closure element 18 may also be of a different shape
and construction,, and the body of valve 15 may preferably
be of integral construction with the rotor housing of
10 circulation pump 8.

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5 Washing Machine Having a Liquid Flow
 Distribution Valve

Patent Claims:

10 1. A washing machine comprising a distribution valve
 for the flow of a liquid circulated by a pump having an
 outlet connected to said valve, the latter being provided
 with at least one closure element and at least a first and
 a second outlet connected respectively to a first and a
15 second liquid flow conduit, said first liquid flow conduit
 extending substantially upwards to a level above said
 second conduit, characterized in that said closure element
 (18) is normally positioned by the action of gravity at a
 stable position adjacent said first outlet (16) and adapted
20 to be displaced to a position obturating said first outlet
 when said pump (8) is actuated during a first phase, a
 calibrated bypass passage (20) connecting said outlet (10)
 of said pump (8) to said first outlet (16) of said valve
 (15), said closure element being adapted at the end of a
25 phase of actuation of said pump to be displaced to an
 instable position adjacent said second outlet (17) and to
 assume a position obturating said second outlet during a
 subsequent actuation phase of said pump (8) only when
 said subsequent actuation phase is initiated within a
30 predetermined period of time after termination of said
 first phase.

2. A washing machine according to claim 1, character-
 ized in that said closure element (18) is adapted to move
35 along inclined guide means (19) between said instable pos-
 ition and said stable position.

3. A washing machine according to claim 1, character-

1 ized in that said calibrated bypass passage (20) includes
means adapted to cause a leakage loss when said closure
element (18) is in said position to obturate said first
outlet (16).

5
4. A washing machine according to claim 1, wherein
said circulation pump is intermittently actuated by a
program control unit with intervening pump stoppage inter-
vals, characterized in that the duration of said intervals
10 is alternatively shorter and longer than said predetermined
interval.

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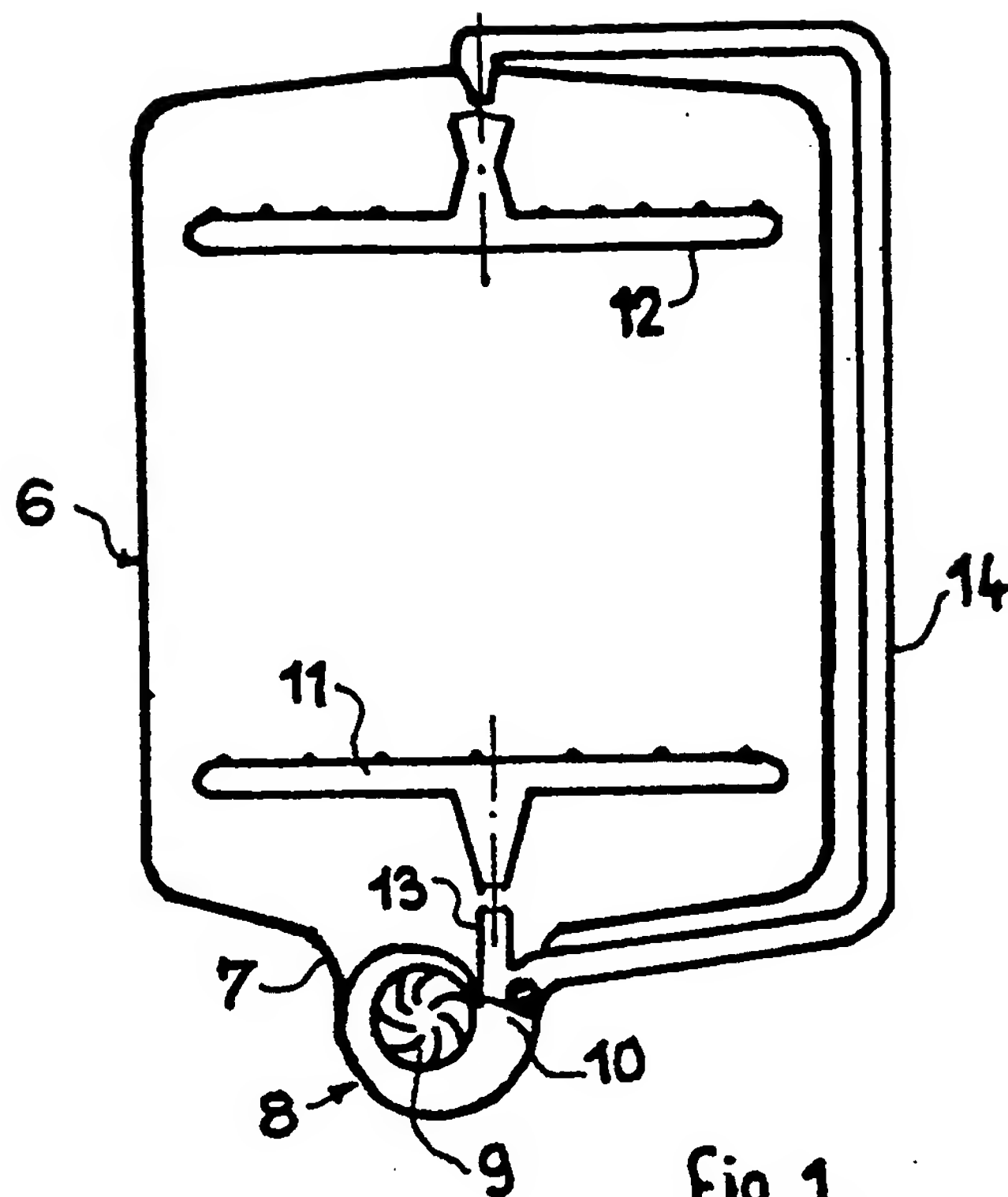
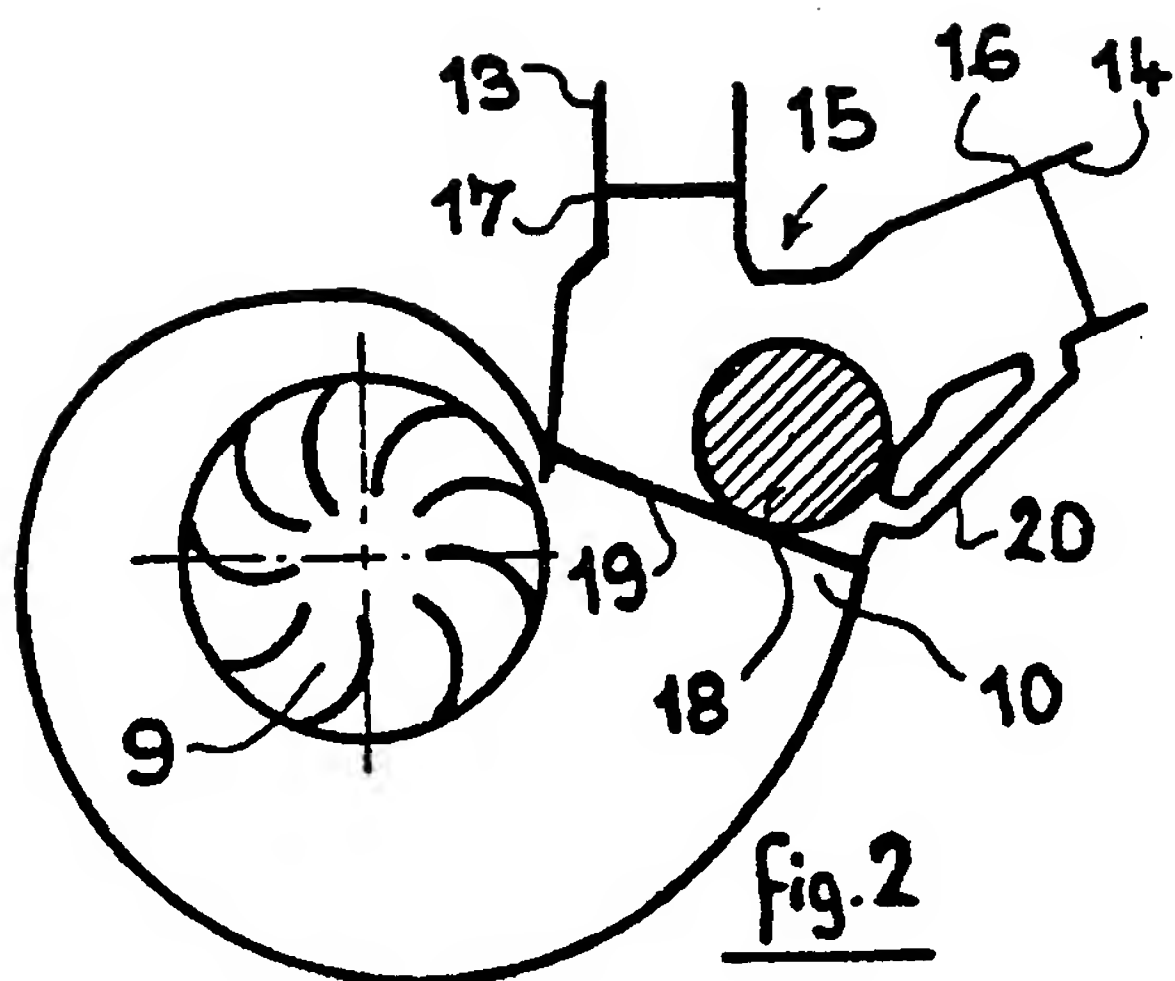
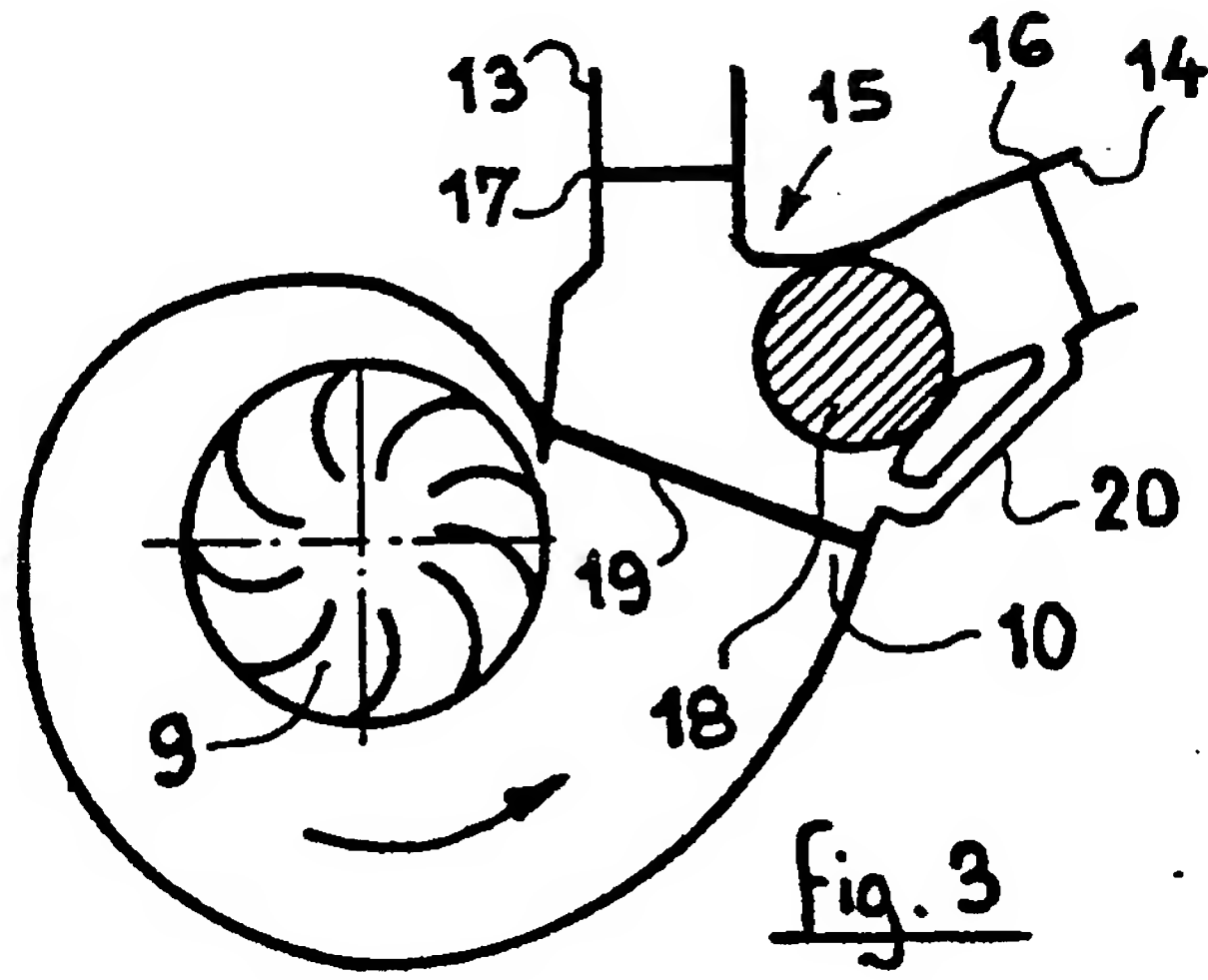
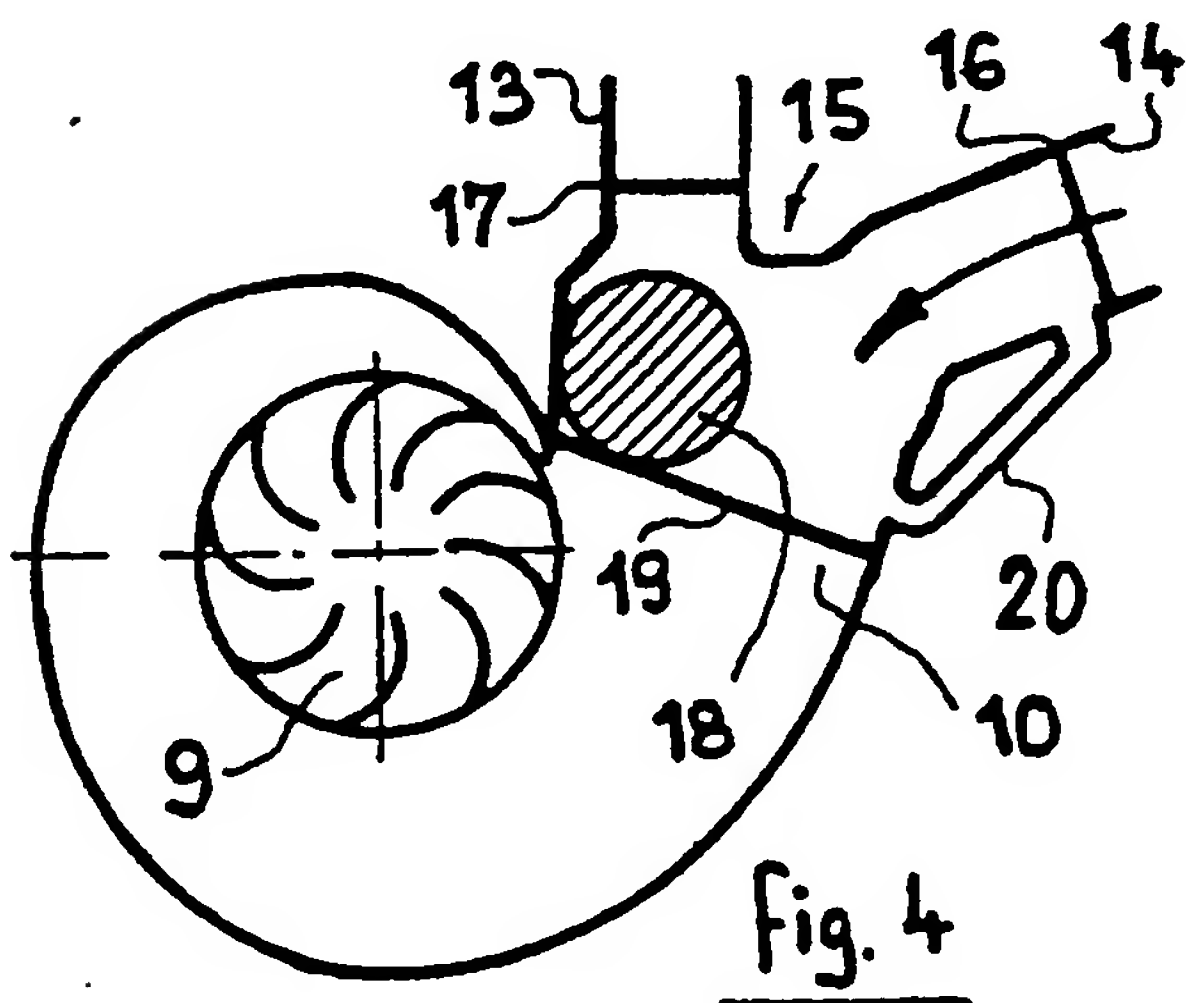
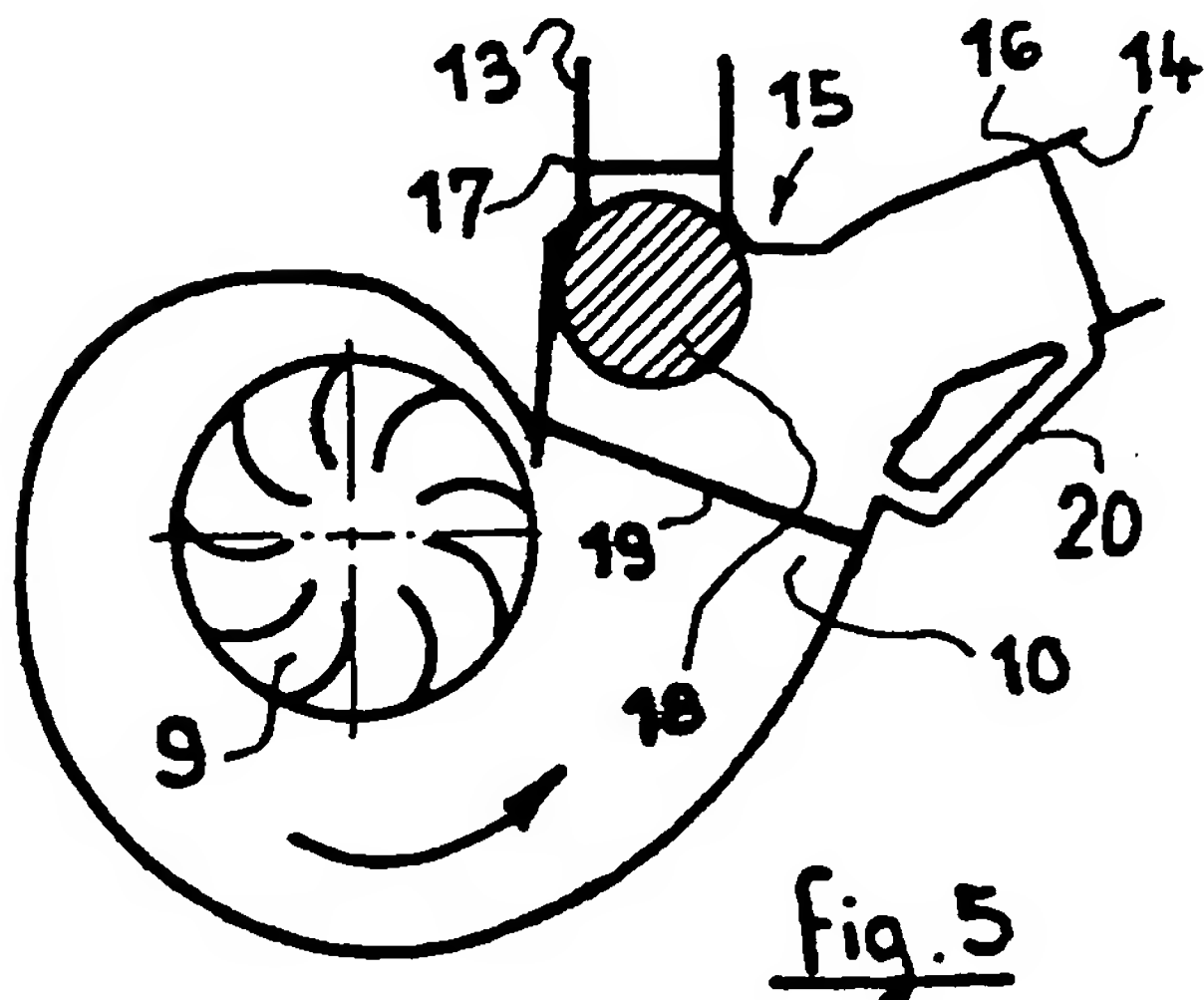
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Fig. 1Fig. 2Fig. 3Fig. 4Fig. 5

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